



EGUsphere, referee comment RC2
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Comment on egusphere-2022-78

Anonymous Referee #2

Referee comment on "An improved near-real-time precipitation retrieval for Brazil" by Simon Pfreundschuh et al., EGU Sphere, <https://doi.org/10.5194/egusphere-2022-78-RC2>, 2022

General Comments: This is an interesting and generally well-written manuscript describing the use of a Convolutional Neural Network (CNN) architecture to retrieve rain rates from the GOES-16 satellite. This effort represents a very significant scientific contribution with results that are very encouraging when compared to other state-of-the-art algorithms. The only significant concern is that the manuscript as presently written assumes a significant prior understanding of these methodologies and thus may not be appropriate for a general audience. A few additional paragraphs of general background information on CNNs and the other techniques used in this manuscript would significantly improve it.

Specific Comments:

- Line 148: What is the purpose for the 4-km experiments given that the ABI has a native resolution of 2 km?
- Line 152: The availability of sunlight does not affect the other IR and WV bands, only the availability of VIS bands. Therefore, it does not justify the use of only a single IR channel. Please clarify the reasoning here.
- Lines 155-156: How are the values of the visible and near-IR bands treated by the CNN to differentiate daytime from nighttime scenes? Or is this something the CNN does without any intervention?
- Sections 3.3 and 3.4: The description of the CNN needs much more detail to be understood by readers who are not experts on CNNs.
- Lines 181-183: Please briefly define terms such as "cross-entropy loss", "logits", and "softmax activation" that would probably be unfamiliar to most readers.
- Line 165: Why is downsampling done for the 2-km retrievals rather than the 4-km retrievals? Shouldn't it be the other way around?
- Line 167: Please provide references to support this assertion about the number of

internal features relative to other architectures.

- Line 178: What in particular makes it easier to compute this sum on the binned PDF than on the quantiles? Please explain this more thoroughly.
- Line 186, 442: Please explain what “the degeneracy of (low) quantiles” means.
- Line 189: What is the rationale for creating outputs for 128 bins if only 14 quantiles are used?
- Line 193: What does “inference” mean in this context?
- Line 196: What does “posterior” mean in this context?
- Lines 203-204: Why specifically will assuming that the retrieval uncertainty is temporally independent cause the uncertainty to decay for consecutive identical observations?
- Lines 279-280: This is true, but it would be very scientifically interesting to see the relative degree of improvement during the day and night e.g., to quantify the value of the visible and near-IR data.
- Line 342: Why does assuming dependent retrieval errors lead to the uncertainties being overestimated?
- Lines 352-355: Please explain the precision-recall curves in Fig. 11 in more detail; they are difficult to understand from the explanation provided.
- Lines 361-362 and 473: How precisely does varying the probability threshold have a “calibrating effect” on the retrieval results?
- Lines 378-379: What probability threshold was tuned, and why was a FAR close to IMERG the criterion for doing so?
- Table 4: Why precisely does correcting when assuming independent errors actually degrade the POD, FAR, and CSI relative to the uncorrected version?
- Figure 13: The use of grayscale for the rain rates and colors for the errors makes the plots very hard to read. Would it be possible to instead plot the satellite rain rates in color and plot the corresponding gauge values using the same color scheme? Similar values would have very little contrast whereas large errors would produce sharp contrasts.
- Line 432 and Fig. 15: Please define more precisely what the 99th percentile of the distribution means. If each point in Fig. 15 is the 99th percentile of all of the rainfall values for a particular gauge location during the month of Dec. 2020, why are there so many values < 5 mm/h? Is it the dry season in some of these locations?
- Lines 435-436: Are there any specific assertions in the published literature that HYDRO and PERSIANN-CCS were both developed to correctly represent heavy precipitation at the presumed expense of skill for lighter precipitation?

Technical Comments:

- Line 39: For consistency, it might be better to cite Schmit et al. (2018) instead of Schmit et al. 2005) since the former is cited in lines 65 and 129.
- Line 46, 55, 93, 574-577: Scofield and Kuligowski (2003a) and (2003b) are the same paper.
- Line 54: Please cite Nguyen et al. (2020) here in reference to PERSIANN-PDIR.
- Line 64: Is “Hydronn” an acronym (e.g., Hydro-Neural Network) or does the name have a different meaning?
- Line 80: Replace “consists” with “consist” (“measurements” is plural).

- Lines 85, 86, 88: "Northwest" should not be capitalized unless it is a proper name.
- Line 86 Many readers may not know that "Amazonas" is the proper name for a state in Brazil, so "the Brazilian state of Amazonas" would be clearer.
- Line 88: Replace "manifest" with e.g., "is associated with".
- Line 118: Replace "available first" with "available only".
- Line 135: replace "criterion" with "approach".
- Lines 133, 386, and elsewhere: please ensure that all dates in this manuscript match the format used in EGU sphere.
- Line 150: A better wording would be "a long time series of geostationary sensors".
- Line 350: Insert "to" before "derive".
- Line 354: Is "retrieved" meant rather than "predicted"?
- Line 354: "Pixel" should be plural.
- Line 362: Is worse detection accuracy than at 5 mm/h meant here?
- Figure 12 caption: add "at a rate of 5 mm/h" to the end of the caption for clarity.
- Line 387: "Floodings" should be singular or replaced with "floods".
- Lines 387, 404, 520: Is this citation and reference formatted correctly?
- Line 388: Replace "were" with "was".
- Line 394: Please indicate the location of Duque de Caxias in Fig. 13.
- Line 430: Replace "by" with "of".
- Line 431: "Runoff" is a single word.
- Line 433: "Station" should be plural.
- Line 434: Replace "similar accuracy as" with "accuracy similar to".
- Line 461: A more precise wording might be "correct for variations in the distribution of precipitation rates in the training data relative to comparable ground validation data."
- Line 465: Replace "stronger" with "more strongly".
- Line 473: Replace "small" with "low".
- Line 475: Constant in time, space, or both?
- Line 485: Please define "GPM CO" in line 69 so the acronym is already defined.
- Lines 485-486: the latitude range of the GPM DPR is actually 65°S to 65°N when the instrument swath is accounted for.
- Line 489: This is the first time that the CNN is described as a "probabilistic regression" approach; this concept should be introduced earlier in the manuscript.
- Line 494: Delete the comma after "resolutions".
- Line 587: "The Python Language Foundation" should be considered as starting with "P" since "The" is ignored when alphabetizing entries.